

SWIFT EDUCATION AND PUBLIC OUTREACH PROGRAM

POST-LAUNCH STATUS REPORT

REVISED: 7/6/05

We outline here the Education & Public Outreach (E/PO) program that accompanies the Swift mission post-launch. Gamma-ray astronomy is an exciting field for the public as well as the researcher. Both young and old can be engaged by the exotic concepts of black holes and violent explosions seen across the Universe. The Swift E/PO program is therefore well suited to promote inquiry into such topics as forces and motions, the structure and evolution of the Universe, and the fundamental relationship between energy and matter. All of these concepts are included in the Science Content Standards A, B, & D for grades 7-12.

For the Swift E/PO program, we continue to focus on the following goal:

We will utilize the observations and scientific discoveries of the Swift mission to improve the understanding and utilization of science and mathematics concepts for grades 7-12.

The flow down of Swift E/PO goals from the specific science goals for Swift is shown in Table 1. The alignment of Swift E/PO goals with the program components and the overall goals of the NASA Science Mission Directorate's Universe Division is also shown in this Table.

1. Swift Mission E/PO Program Components

1.1 Swift E/PO Web Site

At launch, the Swift E/PO web site was completely integrated with the GSFC mission site (<http://swift.gsfc.nasa.gov>), and put into "One-NASA" format. SSU E/PO team members are continuing to maintain and expand the site (<http://swift.sonoma.edu>), so that all formal Swift E/PO materials are available for download from one place. Informal educational materials and public-oriented information about Swift are also available there.

A new web site (<http://grb.sonoma.edu>), which was activated in August 2004, features a sky map that is updated in realtime using information from the Gamma-ray bursts Coordinates Network (GCN) circulars about each gamma-ray burst (GRB) as it is detected by Swift (and also HETE, INTEGRAL and other satellites). Information on burst follow-up is also available in a publicly accessible format by clicking on a specific burst location. We are working with several other institutions that are interested in mirroring this web content, such as our partners in Leicester, England and in Milan, Italy. The site is very popular, averaging several hundred unique visits per day.

1.2 Printed Materials

The most successful educator's guide that we created pre-launch was done in partnership with the GEMS group at the Lawrence Hall of Science. "The Invisible Universe: from Radio Waves

to Gamma Rays” has been the focus of many educator workshops at national, regional, and local venues. We have purchased an additional 1000 of these guides (at cost) to use in post-launch workshops for teachers. One of the activities from this guide (Light Sources and Detectors) was chosen in 2002 by the Origins Forum to feature on the back of a poster about the Electro-magnetic Spectrum that they distributed to over 40,000 teachers nationwide. This activity is also part of the “mini-course” that we have developed for 8th/9th graders and has been piloted in 2005 for an urban charter high school and Boys and Girls Club (both more than 90% Hispanic).

The Gamma-ray Burst Educator Unit was released in September 2004. It includes four well-tested and extensively reviewed activities. It is being used in workshops by the Educator Ambassadors (EAs, see below) and is available in hardcopy through these workshops as well as via download through the Swift E/PO website (<http://swift.sonoma.edu/education/index.html>).

The Swift Model booklet was released in September 2004, and was distributed for launch. It is also being reprinted for further distribution post-launch and is available through the above link.

We plan to revise the activities that accompany our popular Newton’s Laws poster set (originally developed in 2002). Extensive review and testing of these materials has indicated clear directions for improving and expanding these materials. We plan to reprint the poster set, including a fourth poster for the universal law of gravitation, when the materials have been revised and reviewed again.

Other materials developed pre-launch, such as the “Spin-A-Spectrum” and “Who’s Got the Power?”, will continue to be available through downloads from the web site, but will not be reprinted. It is possible that the word problems in the “Spin-A-Spectrum” guide will be adapted for science literacy purposes, if the mission is extended.

1.3 Educator Training

Swift supports five Educator Ambassadors who were chosen in national competitions: Rob Sparks, Rae McEntyre, Bruce Hemp, Dr. Tom Arnold, and David Beier. Sparks and McEntyre attended the first EA training held at SSU in the summer of 2002. Hemp and Arnold were members of the Swift Education Committee (SwEC) for 2001-2003, and have now transitioned into more active roles in reviewing, testing, and disseminating Swift materials through the EA program. All five Swift EAs attended an intensive 10-day training at SSU in July 2004. They learned about the science spanning all SEU missions, and received and tested materials created by many different SEU missions (including the Beyond Einstein program) for use in future workshops. The 2004 EA training presentations are online at: <http://epo.sonoma.edu/ambassadors/training04/index.html>.

We continue to support the participation of these five Swift EAs in local, regional and national conferences. These highly-qualified master teachers have been very successful in distributing Swift educational materials to their peers. Although only four dissemination activities are required from each EA each year, they typically give at least five workshops. In 2004, the five Swift EAs conducted 24 workshops and reached 2500 teachers directly.

Three Swift EAs (Hemp, Sparks, and Beier) were in Florida to experience the Swift launch, and got to climb up the rocket gantry prior to fueling. However due to launch delays, only Hemp was able to stay in Florida to see the launch itself. Nevertheless, this was a very exciting experience for the teachers, and helped them to convey the NASA spirit to their classes and fellow educators.

SSU team members participate annually in educator workshops, including NSTA and AAPT, and staff an exhibit booth at regional educator conferences such as CSTA.

The Appalachian Regional Project is continuing at Penn State through the summers of 2004 and 2005 with a week-long course on Space-based Astronomy. This course was first introduced in the summer of 2003 and was very successful.

1.4 Informal Education

Video: What's In the News? (WITN) was a multimedia children's current events program produced weekly throughout the school year by Penn State Public Broadcasting (WPSX). Aimed primarily at grades 4-7, the programs reached roughly 4.5 million children in 32 states and Iceland. In addition to the television broadcast, WITN provided printed support materials, newspaper columns, and Web-based resources for both students and educators. Broadcasts included two types of presentations – a 15 minute feature story and 2-3 minute “news” segments.

We produced 12 features and/or news segments about Swift during the years 2000-2004. However, in April 2004, we were informed that WPSX was discontinuing WITN due to budgetary cutbacks at the University. We have archived all the WITN Swift video segments on the E/PO website so they continue to be available.

The WPSX staff, in conjunction with faculty at the Penn State School of Education has “recycled” some of the WITN video segments into a six-segment, 30 minute video, each segment of which is accompanied by an educational activity, which focuses on the development of the scientific inquiry process. This Swift educational video series has completed technical review and will be beta-tested starting in the summer of 2005 by the Educator Ambassadors and by teachers attending the PSU summer astronomy teacher workshops.

The Swift launch will be featured in the planetarium show that is accompanying the PBS NOVA show on black holes. This planetarium show is expected to premiere in late 2005 and is entirely funded by the NSF grant (PI Thomas Lucas) that was seeded through the GLAST E/PO program. It is entitled “Black Holes: The Other Side of Infinity” and has many simulation sequences including what it would be like to fall into a black hole. The show is being produced by Tom Lucas, in conjunction with the Denver Museum of Nature and Science, and it will be distributed to other full format digital planetaria through Spitz, Inc. The launch may also appear in the PBS NOVA show, but that is not clear at the present time, as the script is evolving.

Remote Observing using GTN: Swift bursts are being transmitted via the GCN to the partners in the Global (formerly GLAST) Telescope Network, and, whenever possible, will be observed by the 14-inch SSU Robotic Telescope at Pepperwood Observatory. We are actively recruiting high

school students to participate in “burst chasing” as an informal educational activity. Now operational, the Pepperwood telescope is accessible through the internet, allowing students to remotely participate in the thrill of real research, in partnership with NASA scientists.

2. Evaluation, Assessment, Dissemination and Reporting

WestEd continues to be responsible for the formal program evaluation and guidance of the Swift mission E/PO program. Led by Dr. Edward Britton, WestEd conducts independent formative and summative evaluations on a regular basis using professionally accepted qualitative and quantitative assessment tools such as questionnaires, telephone interviews, and focus groups. Evaluation of the training of teachers, classroom usage and student learning outcomes are the ultimate goals of our assessment process. Assessment includes each individual part of the Swift E/PO program, as well as measuring the overall effectiveness of the parts working together to quantify the true impact of our efforts in the education and general public communities. The results of the evaluations are submitted at least quarterly to E/PO Lead Cominsky, who in turn conveys the reports to Swift PI Neil Gehrels and to HQ on a regular basis. See Table 2 for details of the past, current and future evaluation schedule.

The SwEC has been meeting at least every other year, and most recently met in October 2003 at GSFC. The prime directive of the SwEC is to "advise and monitor the performance of the Swift E/PO program." SwEC meetings have provided an opportunity for the E/PO team members and Educator Ambassadors to review the printed curriculum materials, and discuss future plans.

NASA E/PO programs are required to submit records of all activities to EDCATS, and to enter all downloadable educational materials into the SSERD. Swift E/PO activities have been reported for the past three years, and summaries have appeared in the NASA OSS E/PO annual report. All released Swift educational materials are entered into the SSERD.

Year-end reports are compiled by Cominsky and submitted to Swift PI Gehrels and to HQ. These reports include the results of all external and SwEC evaluations, as well as the EDCATS totals for all Swift E/PO activities.

3. Swift E/PO Management

The organization of the Swift E/PO effort is shown in Figure 1. The Swift PI, Dr. Neil Gehrels, has full responsibility for guiding the mission, including E/PO activities. Dr. Gehrels is fully committed to E/PO and 1) provides oversight on the E/PO program to ensure that all E/PO products are scientifically accurate and technically correct; 2) ensures that all E/PO activities are consistent with the scientific and technological goals of the mission; and 3) participates personally in the E/PO program through video-taped interviews, local presentations and public outreach efforts.

At Sonoma State University, E/PO lead and science Co-I Prof. Lynn Cominsky oversees the E/PO program under the direct supervision of the Principal Investigator. Prof. Cominsky 1) provides a focused direction for the SSU and Penn State partners; 2) coordinates all E/PO

activities with all participants, including the mission science, SSU and PSU teams, the Science Mission Directorate E/PO, and the NASA Office of Education and the external evaluators at WestEd; 3) ensures that the mission science will be combined with innovative learning ideas and aligned with national science and mathematics standards; 4) represents the E/PO group at all science team management meetings and reviews; and 5) provides lead work direction to the Educational Resource Director (Dr. Phil Plait) and the Program Manager (Sarah Silva). In the past, she also served as final technical reviewer and interface to the Lawrence Hall of Science GEMS group, as we developed the *Invisible Universe: From Radio Waves to Gamma rays* Educator's Guide.

The E/PO Program Manager Sarah Silva 1) manages the Swift E/PO program on a daily basis, coordinating all programs and activities under the direction of the E/PO lead. She 1) supervises the other SSU E/PO staff including the Instructional Technology Expert, the Scientific Illustrator and the Project and Student Assistants; 2) is responsible for originating and tracking all budgets, subcontractor contracts and schedules; 3) directs the Educator Ambassadors program; 4) contributes to the design and development of educational products and workshops for both students and teachers; and 5) is the main point of contact for the Science Mission Directorate Support Network, ensuring Swift participation in a wide variety of multi-mission activities.

The Education Resource Director, Dr. Phil Plait, is primarily responsible for science content development, having authored both the E/PO website content and the GRB Education Unit. Dr. Plait writes all the burst summaries for the real-time sky map GRB website and was also responsible for the content of the WITN segments. He is responsible for ensuring standards alignment for the science and mathematics areas. He has also contributed to the other written materials including the model booklet, fact sheets, lithographs and magazine articles. He represents the project at management meetings if Prof. Cominsky is unavailable, and also conducts workshops for both students and teachers.

The Instructional Technology Expert, Tim Graves, was responsible for the design and implementation of the Gamma-ray burst real-time sky map website, and the construction, development, operation and GCN connection to the SSU Pepperwood telescope. He also oversees the maintenance and support of all Swift E/PO computer and server equipment.

Scientific Illustrator Aurore Simonnet is responsible for the design and layout of all graphical components of the Swift E/PO materials. She created the GRB poster, and has done layout and illustration for the GRB education unit, various brochures, flyers and lithos, the Swift sticker, graphics for the web site, and all other printed materials.

The SSU group also employs a project assistant and student assistants to perform general office administration, including regular mailing to the Educator Ambassadors and E/PO network, general web administration and upkeep, ordering and receiving E/PO materials and other communications tasks.

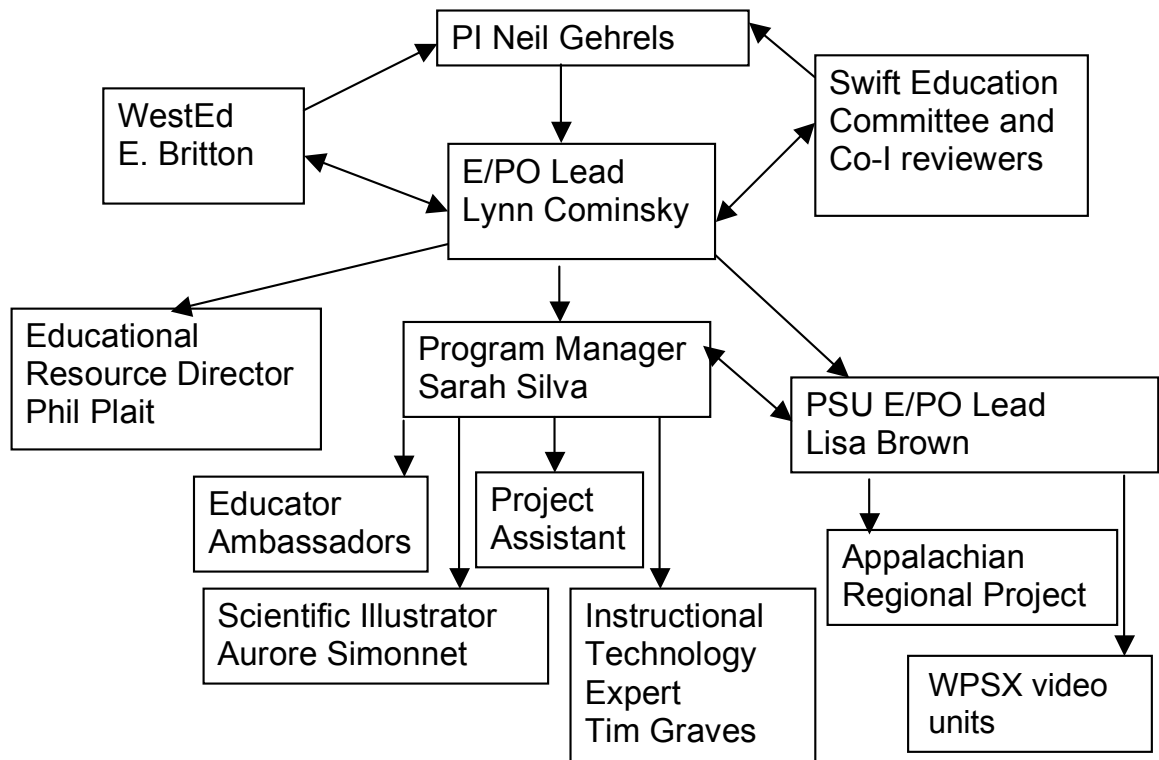
Members of the Swift science team including Co-Is John Nousek, Dave Burrows and Margaret Chester (Penn State), and Padi Boyd and Ann Parsons (GSFC), are committed to providing oversight and input to the E/PO effort for Swift, ensuring the accuracy in the materials' content.

They also speak to students and the public, and provide input into the design of the E/PO products. Parsons and Nousek participated in interviews for the WITN video segments, and Parsons, Nousek and Gehrels appear in the additional videos that are being used in the educational unit from Penn State. At GSFC, JD Myers is responsible for interfacing the Swift mission web site with the E/PO site, and supporting the exhibit booth at scientific meetings.

Sonoma State University (SSU), as the lead institution for Swift E/PO, subcontracts some work items to the Penn State team, directed by Dr. Lisa Brown. Dr. Brown is responsible for overseeing contract administration, budget and schedule for the Penn State E/PO activities: ARP and WITN and the new Swift educational video series. Prof. Eric Feigelson is responsible for ensuring the content and pedagogy of the Space-based astronomy summer teacher workshop in conjunction with ARP. Katie O'Toole was responsible for the production of the WITN segments and Tracy Vosburgh is responsible for the Swift educational video series.

External evaluation of the program is performed by WestEd, under the direction of Dr. Edward Britton. WestEd employs specialists in evaluating content in science, mathematics, technology, web site design and teacher training, and conducts implementation, formative and summative reviews of the Swift E/PO program.

Figure 1 - Swift E/PO Organization



	<u>Table 1 – Swift E/PO Goals</u>	How do galaxies, stars, and planetary systems form and evolve?	What happens to space, time and matter at the edge of a black hole?	What are the cycles of matter & energy in the evolving universe?	
Science Goals	E/PO Goals	Universe Division Goals			Program Components
What is the origin of gamma-ray bursts?	Use GRBs as an engagement to teach students about the electromagnetic spectrum, as well as the interactions between energy and matter and scientific methods	X	X	X	1.2 1.3 1.4
What is the classification of gamma-ray bursts and are there any undiscovered types?	Use different types of bursts to teach students how scientists use classification schemes to further insights into physical properties	X		X	1.2 1.3
How do the blast waves evolve and interact with their surroundings?	Use the interactions between energy and matter in GRBs to teach basic physical principles to students in grades 5-12	X		X	1.2 1.3
What can gamma-ray bursts tell us about the early Universe?	Facilitate an understanding by students and the general public of the connection between GRBs, the first generation of stars and other objects in the Universe	X		X	1.1 1.4

Table 2 – Swift Evaluation Schedule

WestEd will conduct any or all of the following evaluation tasks for SSU-developed or SSU-sponsored classroom resources:

- (i) arrange and observe field-testing
- (ii) arrange discussion via teleconferencing between SSU and teacher evaluators
- (iii) expert appraisal of instructional design features as part of formative review

These evaluation tasks will focus on the following materials:

E/PO Program Element	Material to be evaluated	Evaluator's Tasks
Fiscal Year 06		
1.2	Newton's Laws Revised (formative)	(i), (ii), (iii)
1.3	Educator Ambassador Program (summative)	(i), (iii)
Fiscal Year 05		
1.1	Swift Website	(iii)
1.3	Educator Ambassador Program and workshop follow-up (formative)	(i)
Fiscal Year 04		
1.3	Educator Ambassador Program (formative)	(i), (iii)
1.2	Gamma-ray Burst Educator Unit	(i), (ii), (iii)
Fiscal Year 03		
1.2	Newton Posters (formative)	(i), (ii)
1.3	AAPT Annual National Meeting (GEMS)	Effectiveness of materials dissemination
1.4	Swift Launch Outreach	Evaluation of planning
Fiscal Year 02		
1.2	Evaluate Swift materials during EA training: GEMS #2, Spin-a-Spectrum	(i)
Fiscal Year 01		
	Develop evaluation instruments for teacher workshops	(i)
1.2, 1.3	Evaluate Swift materials during Penn State Teacher's Workshop: Spin-a-Spectrum, Who's Got the Power and Waves Light Up the Universe	(i)
1.3	Evaluate Teacher's Workshop in Baltimore, MD that accompanied Gamma 2001 – Waves Light Up the Universe	(i)